

RESEARCH HIGHLIGHT
Basic Energy Sciences Program
Geosciences Subprogram

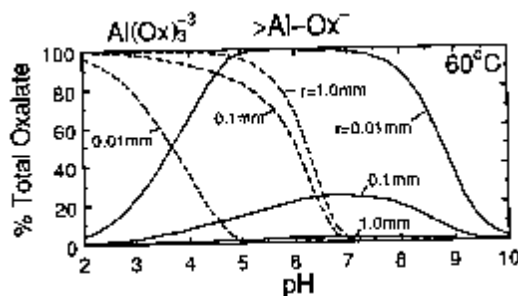
Project: Mineral Hydrolysis

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Objective: Funding for this project ended in FY94. Results from this project were used to examine mineral-fluid interactions and specifically focus on mineral dissolution mechanisms.

Results: During diagenesis carboxylic acids are able to complex and mobilize Al, in the process de-stabilizing aluminosilicates and contributing to the evolution of subsurface porosity. Adsorbed carboxylic acid anions also affect porosity evolution by catalyzing the dissolution of primary feldspars and accelerating the growth of secondary clays. Despite the importance of mineral surfaces to the process very little is known about the degree to which organic acid anions interact with

minerals at depth. We have measured adsorption of oxalate onto Al_2O_3 at 25 C and 60 C as a function of pH. A constant capacitance surface complexation model was used to analyze the results and determine adsorption stoichiometries. Surface complexation constants were then combined with high-temperature Al-carboxylate aqueous complexation constants to determine the transport potential of oxalate in siliciclastic basins undergoing diagenesis. When grain sizes are small (radius < 0.1mm; pH < 7 at 60°C) in quartz-kaolinite dominated rock oxalate is primarily bound to mineral surfaces, and minimal oxalate remains in solution to complex Al and de-stabilize Al-containing minerals. Appreciable Al-Oxalate transport can only occur at lower pH, and/or larger grain size. These results support the hypothesis that mineral surfaces take on a greater role in regulating chemical transport at high temperatures. Our results have been accepted for publication in Chemical Geology; this work is the result of a collaboration with Jeremy B. Fein at McGill University in Montreal, Canada.



Significance: These results indicate that assessments of mineral and fluid stability and reaction potential at $T > 25^\circ\text{C}$ may depend greatly on the affinity of the aqueous species for mineral surfaces.